COMAL-80 Cheat Sheet (Commodore 64)

Compact, one-page reference for experienced programmers. Use this alone to write and run COMAL programs on the C-64.

Quick rules & conventions

- Case-insensitive keywords. Comments begin with `//`.
- Strings end with `$` name (e.g., `s$`).
- Numeric types: `INTEGER` (−32768..32767), `REAL` (floating). Hex `$NNNN`, binary `%....`
- Use `DIM name OF n` for arrays/strings: `DIM names(10) OF 20`, `DIM buf OF 80`.
- Use `SCAN` before `RUN` to validate and register procedures.

Expression summary

- Precedence: `()` → `^`/`EXP` → `* / DIV MOD` → `+ -` → `BITAND BITOR BITXOR` → relational `< <= = <> >= >` → logical `NOT AND AND THEN OR OR ELSE`.
- Common functions: `INT(x)`, `ABS(x)`, `SGN(x)`, `SQR(x)`, `SIN/COS/TAN/ATN`, `LOG/EXP`.
- Strings: `LEN(s$)`, `CHR$(n)`, `ORD(ch)`, `VAL(s$)`, `s$(start:length)` or `MID$` depending on dialect.

Core statements (short forms)

- Flow: `IF ... THEN ... [ELIF ...] [ELSE ...] ENDIF`
- Branch: `CASE ... OF WHEN ... OTHERWISE ENDCASE`
- Loops: `FOR i=.. TO .. [STEP ..] DO ... ENDFOR`; `WHILE ... DO ... ENDWHILE`; `REPEAT ... UNTIL cond`.
- Other: `LOOP ... EXIT WHEN cond ENDLOOP`.
- File: `OPEN FILE n,"name",READ|WRITE|APPEND|RANDOM`; `INPUT FILE n: var`; `PRINT FILE n: expr`; `CLOSE FILE n`.
- Program: `NEW`, `RUN`, `CHAIN "file"`, `SAVE "name"`, `LOAD "name"`, `VERIFY`.

Procedures & functions

- Define proc: `PROC name(params) ... ENDPROC name`.
- Define func: `FUNC name(params) ... RETURN expr ENDFUNC name`.
- Parameter passing: by value or reference. Arrays and strings require descriptors.
- Use `CLOSED` for file-local procedures; `EXTERNAL` to declare external ones.

Example:

```
PROC polygon(n,len)
  FOR i=1 TO n DO
    forward(len)
    right(360/n)
  ENDFOR
ENDPROC polygon
```

Packages (enable hardware features)

- `LINK "module.obj"` — load machine-language module (optional).
- `USE <package>` — activate package (calls init). Examples: `turtle`, `graphics`, `sprites`, `sound`,

paddles, joysticks, lightpen, font, english/dansk.
- DISCARD — remove all non-ROM modules.

Essential Turtle/Graphics orders

(After USE turtle) - forward(L), back(L), left(D), right(D), setheading(H) - penup, pendown, hideturtle, showturtle, home, clearscreen - pencolor(C), background(C) — use Appendix color codes. - Hold graphics: WHILE KEY$ = CHR$(0) DO NULL.

Sprites (core)

- startsprite(id), stopsprite(id), movesprite(id,x,y), spritecolor(id,c)
- loadshape(id,"file"), saveshape(id,"file"), spritetype(id,mode), sprsize(id,scale)
- Query collision flags via package helpers.

Sound (core)

- USE sound
- soundtype(voice,type), adsr(voice,a,d,s,r), note(voice,code$), gate(voice,1|0), volume(n)
- Sequencing: setscore(), playscore(), waitscore().

Peripherals & ports (practical)

- Game ports: use USE paddles and paddle(port,ap,bp,ab,bb) to read analog/digital inputs.
- Parallel (user port): addresses example: portB=56577 ($DD01), ddr=56579 ($DD03).
  - Set DDR: POKE ddr, %00000010 (bit1 output, bit0 input).
  - Read bit0: IF (PEEK(portB) BITAND 1)=1 THEN ....
  - Set output bit1: POKE portB, PEEK(portB) BITOR 2.

Machine-language integration (practical essentials)

- LINK "module.obj" to load module; USE package to expose procs/funcs.
- ML must provide package tables and procedure headers in COMAL format.
- In ML, call JSR FNDPAR with A=parameter-number to get parameter pointer (COPY1) — required to access actual parameter storage.
- Return values: push result in COMAL format (use supplied runtime helpers); for strings, build on the evaluation stack.

Memory map (practical)

- Key areas: 0x0000 zero page, 0x0400 screen, 0x0800-0x7FFF working RAM, 0x8000-0xBFFF cartridge ROM/overlays, 0xC000-0xFFFF KERNAL/BASIC ROM.
- COMAL cartridge: four 16KB pages in 8000–BFFF; optional EPROM expansion pages.

Errors & trapping

- TRAP label / HANDLER ... ENDTRAP to catch errors.
- Raise a COMAL error: REPORT n (COMAL) or RUNERR (from ML). Provide ERR, ERRFILE, ERRTEXTS for handlers.
- Use SCAN to detect syntax/structure errors early.

Handy patterns & tips

- Keep procedures small and modular; `SCAN` frequently.
- Save often (two copies recommended).
- Activate only the packages you need with `USE` to conserve memory.
- For ML, preserve registers and use `FNDPAR` for parameter safety.

One-line cheats (most-used commands)

- `USE turtle`, `splitscreen`, `forward(50)`, `right(90)`
- `PROC name(...) ... ENDPROC`, `FUNC f(...) RETURN ... ENDFUNC`
- `OPEN FILE 1,"f",READ`, `INPUT FILE 1: x`, `PRINT FILE 1: x`
- `SAVE "prog"`, `LOAD "prog"`, `RUN`
- `LINK "m.obj"`, `USE pkg`, `DISCARD`
- `TRAP lbl`, `REPORT n`, `HANDLER ... ENDTRAP`

File: `COMAL-80-cheatsheet.md` — saved in the COMAL folder. Tell me if you want this exported to PDF or tightened to a single printed A4 layout.